THIS OPINION WAS NOT WRITTEN FOR PUBLICATION

The opinion in support of the decision being entered today (1) was not written for publication in a law journal and (2) is not binding precedent of the Board.

Paper No. 19

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte SIEGFRIED MANTL,
BERND HOLLANDER
and RAINER BUTZ

Appeal No. 94-3365
Application 07/759,571[1]

HEARD: JULY 17, 1997

Before GARRIS, GRON and PAK, Administrative Patent Judges.

PAK, Administrative Patent Judge.

DECISION ON APPEAL

Siegfried Mantl et al. (appellants) appeal from the final rejection of claims 1 through 11, which are all of the claims in the application.

[1] Application for patent filed September 13, 1991.

THE CLAIMED SUBJECT MATTER

The subject matter on appeal is directed to a method of forming a mixed-crystal structure or a crystalline chemical compound film having desired properties on a crystalline substrate, without the formation of lattice defects at the interface thereof. See specification, page 2, lines 13-18, and page 3, lines 10-11, and claim 1. The method comprises initially providing a commercially available SIMOX-wafer as a starting material. See specification, pages 6 and 7, examples 1 and 2. The SIMOX-wafer consists of a crystalline silicon substrate, a buried amorphous silicon dioxide layer and a monocrystalline silicon surface layer. See specification, examples 1 and 2 in conjunction with claim 1, step (a). The monocrystalline silicon surface layer of the SIMOX-wafer is subsequently transformed into a mixed-crystal structure or a crystalline chemical compound. See specification, page 4 in conjunction with claim 1, step (b). The unaltered amorphous layer interposed between the mixed-crystal structure or the crystalline chemical compound and the crystalline substrate precludes "the propagation of defects from the interface" due to "no communicated stresses at the crystalline/amorphous interface." See specification, page 3, lines 12-20.

The mixed-crystal or crystalline chemical compound includes a particularly formed Si-Ge film or $CoSi_2$. See specification, pages 6 and 7, examples 1 and 2. The resulting composition is said to be useful for electronic, electrooptic or optical components. See specification, page 3, lines 4-5 in conjunction with claim 1.

Claim 1 is representative of the subject matter on appeal and reads as follows:

1. A method of making a crystalline element for an electronic, electrooptic or optical component, comprising:

(a) providing a crystalline substrate having a buried amorphous layer formed therein and a monocrystalline layer on said amorphous layer and separated from said substrate by said amorphous layer; and

(b) transforming said monocrystalline layer into a mixed-crystal structure or a crystalline chemical compound, whereby said amorphous layer is interposed between said substrate and said structure or compound.

PRIOR ART

As evidence of obviousness, the examiner relied on the following references:

Maeguchi	4,463,492	Aug. 7, 1984
Mao et al (Mao)	4,902,642	Feb. 20, 1990 (filed Aug. 24, 1988)
Ishizaka et al. (Ishizaka)	5,047,111	Sep. 10, 1991 (filed Oct. 16, 1987)

REJECTIONS

The appealed claims stand rejected as follows:

(1) Claims 1 through 6 and 9 through 11 under 35 U.S.C. § 103 as unpatentable over the combined disclosures of Mao and Ishizaka; and

(2) Claims 7 through 8 under 35 U.S.C. § 103 as unpatentable over the combined disclosures of Mao and Maeguchi.

CONCLUSION

We reverse each of the above rejections.

OPINION

The examiner has rejected claims 1 through 6 and 9 through 11 under 35 U.S.C. § 103 based on the combined disclosures of Mao and Ishizaka. The examiner relied on the Mao reference to show a SIMOX-type structure having a crystalline silicon substrate, a buried amorphous silicon dioxide layer and a monocrystalline silicon surface layer. See Answer, the unnumbered page and page 3 in conjunction with Mao, Figure 3 and Example 1. The examiner found and appellants do not dispute that the SIMOX-type structure disclosed by the Mao reference is "a starting material for device manufacture and is not a final product." Compare the entire Brief with Answer, page 3. The examiner, however, correctly recognized that the Mao reference does not disclose transforming

the monocrystalline silicon surface layer of the SIMOX-type wafer into a mixed-crystal structure or a crystalline chemical compound. See page 3 of the Answer. Thus, the examiner relied on the Ishizaka reference to establish that the transformation of the monocrystalline silicon surface layer of the SIMOX-type wafer into a mixed-crystal structure or a crystalline chemical compound, without altering the buried amorphous layer, would have been obvious to one skilled in the art.

At issue is, therefore, whether the Ishizaka reference provides sufficient suggestion or motivation to transform the monocrystalline silicon surface layer on the buried amorphous layer to arrive at the claimed subject matter.

As stated by the examiner at the unnumbered page and page 4 of the Answer, Ishizaka does disclose that as a method of growing epitaxially a monocrystalline film of $CoSi_2$ or $NiSi_2$ on single crystal silicon underlie, the solid phase epitaxy in which an Ni or a Co film reacts with a Si substrate has been known. See column 1, lines 17-21 and lines 37-41. This reaction, however, includes diffusion of Ni or Co atoms into Si substrates, thus causing the resultant film to have inferior morphology. See column 1, lines 26-30, and column 1, lines 41-45. To avoid this and other disadvantages associated with the conventional solid

phase epitaxy, the Ishizaka reference requires deposition of a multi-layer structure of Si and M (Ni or Co) on a crystalline silicon substrate at a certain temperature range followed by annealing at the particular condition to form a MSi_2 structure on the substrate. See columns 2, 3 and 4. Not only does the Ishizaka reference teach away from diffusing Ni or Co into a crystalline silicon substrate (i.e., causing the transformation of a monocrystalline silicon structure), but it also would not have suggested maintenance of a buried amorphous layer in the same amorphous state before or during the transformation of the monocrystalline silicon surface layer. Under these circumstances, we cannot agree with the examiner that the Ishizaka reference would have suggested to one of ordinary skill in the art to transform the monocrystalline silicon surface layer of the SIMOX-type wafer taught by the Mao reference into a mixed-crystal structure or a crystalline chemical compound, without altering the amorphous layer, within the meaning of 35 U.S.C. § 103. Accordingly, we reverse the rejection of claims 1 through 6 and 9 through 11 over the above references.

The examiner has also rejected claims 7 and 8 under 35 U.S.C. § 103 based on the combined disclosures of Mao and Maeguchi. Claim 7 is dependent on independent claim 1. Claim 8 is dependent on claim 7 which depends on claim 1. In other words, dependent claims 7 and 8 embrace all of the limitations recited in independent claim 1, requiring, inter alia, transformation of a monocrystalline silicon surface layer covering a buried amorphous layer into a mixed-crystal or a crystalline chemical compound. The examiner, however, failed to discuss or explain how the Mao and the Maeguchi references would have rendered this step obvious within the meaning of 35 U.S.C. § 103. We cannot find any teaching or suggestion in these references regarding the transformation of the monocrystalline silicon surface layer covering the buried amorphous layer into the mixed crystal or the crystalline chemical compound. Accordingly, we reverse this rejection as well.

The decision of the examiner finally rejecting claims 1 through 11 under 35 U.S.C. § 103 is reversed.

REVERSED

BRADLEY R. GARRIS Administrative Patent Judge	)	
TEDDY S. GRON Administrative Patent Judge	)	BOARD OF PATENT APPEALS AND INTERFERENCES
CHUNG K. PAK Administrative Patent Judge	)	

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